

WHAT IS CLAIMED IS:

- 1     1.     An optical device comprising:  
2                 an optics system comprising an input to receive optical signals in  
3     an incoming direction and an output to selectively transmit a selected optical  
4     signal of said optical signals in an outgoing direction, said optics system being  
5     configured to selectively rotate one of the polarization components of each of said  
6     optical signals in said incoming direction to a first polarization state;  
7                 an optical unit optically coupled to said optics system, said optical  
8     unit being configured to laterally displace and rotate said polarization components  
9     of said selected optical signal such that said polarization components of said  
10    selected optical signal in said outgoing direction are in said first polarization state;  
11    and  
12                 a diffraction grating positioned between said optics system and said  
13    optical unit to diffract said polarization components of said selected optical signal  
14    in said incoming and outgoing directions, said polarization components of said  
15    selected optical signal being in said first polarization state in both said incoming  
16    and outgoing directions at said diffraction grating.
- 1     2.     The optical device of claim 1, wherein said diffraction grating has a  
2     grating line frequency greater than 900 grating lines per mm.
- 1     3.     The optical device of claim 1, wherein said optical unit comprises a walk-  
2     off crystal and a wave plate positioned such that said polarization components of  
3     said selected optical signal in said outgoing direction are selectively transmitted  
4     through said wave plate.
- 1     4.     The optical device of claim 1, wherein said optical unit comprises a  
2     Wollaston prism and a wave plate positioned such that said polarization  
3     components of said selected optical signal in said outgoing direction are  
4     selectively transmitted through said wave plate.

1     5.     The optical device of claim 1, wherein said optical unit comprises a  
2     polarizing beamsplitter and a wave plate positioned such that said polarization  
3     components of said selected optical signal in said outgoing direction are  
4     selectively transmitted through said wave plate.

1     6.     The optical device of claim 1, further comprising a controllable switching  
2     array, said controllable switching array including pixels with changeable optical  
3     property.

1     7.     The optical device of claim 6, wherein said pixels include electrically  
2     controllable birefringent material.

1     8.     The optical device of claim 7, wherein said electrically controllable  
2     birefringent material is one of liquid crystal and lithium niobate.

1       9.           An optical device comprising:  
2                   an input optical unit comprising an input to receive optical signals,  
3       said input optical unit being configured to selectively rotate one of the polarization  
4       components of each of said optical signals to a first polarization state;  
5                   an output optical unit comprising an output to selectively transmit  
6       said polarization components of a selected optical signal of said optical signals;  
7                   a diffraction grating optically coupled to said input and output  
8       optical units to diffract said polarization components of said optical signals to and  
9       from said input and output optical units;  
10                  an active optical element optically coupled to said diffraction  
11       grating, said active optical element being configurable to selectively convert said  
12       polarization components of said selected optical signal from said first polarization  
13       state to a second polarization state; and  
14                  an intermediate optical unit positioned between said diffracting  
15       grating and said active optical element, said intermediate optical unit being  
16       configured to laterally displace and rotate said polarization components of said  
17       selected optical signal in an outgoing direction from said second polarization state  
18       to said first polarization state such that said polarization components of said  
19       selected optical signal are in said first polarization state at said diffraction grating  
20       in both said incoming and outgoing directions.

1       10.       The optical device of claim 9, wherein said diffraction grating has a  
2       grating line frequency greater than 900 grating lines per mm.

1       11.       The optical device of claim 9, wherein said intermediate optical unit  
2       comprises a walk-off crystal and a wave plate positioned such that said  
3       polarization components of said selected optical signal in said outgoing direction  
4       are selectively transmitted through said wave plate.

1       12.       The optical device of claim 9, wherein said intermediate optical unit  
2       comprises a Wollaston prism and a wave plate positioned such that said  
3       polarization components of said selected optical signal in said outgoing direction  
4       are selectively transmitted through said wave plate.

1 13. The optical device of claim 9, wherein said intermediate optical unit  
2 comprises a polarizing beamsplitter and a wave plate positioned such that said  
3 polarization components of said selected optical signal in said outgoing direction  
4 are selectively transmitted through said wave plate.

1 14. The optical device of claim 9, wherein said active optical element  
2 comprises a controllable switching array, said controllable switching array  
3 including pixels with changeable optical property.

1 15. The optical device of claim 14, wherein said pixels comprises electrically  
2 controllable birefringent material.

1 16. The optical device of claim 15, wherein said electrically controllable  
2 birefringent material is one of liquid crystal and lithium niobate.

1 17. A method for transmitting a selected optical signal, said method  
2 comprising:  
3 receiving optical signals;  
4 selectively rotating polarization components of said optical signals  
5 to a first polarization state;  
6 diffracting said polarization components of said optical signals in  
7 said first polarization state to spatially separate said polarization components;  
8 selectively converting said polarization components of a selected  
9 optical signal of said optical signals from said first polarization state to a second  
10 polarization state;  
11 laterally displacing said polarization components of the selected  
12 optical signal;  
13 rotating said polarization components of said selected optical signal  
14 from said second polarization state back to said first polarization state;  
15 diffracting said polarization components of said selected optical  
16 signal in said first polarization state; and  
17 outputting said polarization components of said selected optical  
18 signal.

1    18.    The method of claim 17, wherein said converting includes reflecting said  
2    polarization components of said optical signals.

1    19.    The method of claim 17, wherein said converting includes converting said  
2    polarization components of said selected optical signal from said first polarization  
3    state to said second polarization state in response to an electrical control signal.

1    20.    The method of claim 17, wherein said laterally displacing includes  
2    transmitting said polarization components of said selected optical signal through a  
3    device that only laterally displaces said polarization components in said second  
4    polarization state.